

## GAPs Systems Approach Moving from Awareness to Action

- ❖ Brief overview of GAPs & GHPs
- ❖ A few GAPs examples



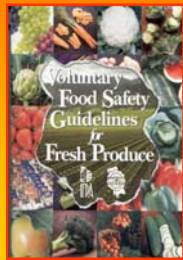
<http://ucfoodsafety.ucdavis.edu>  
<http://ucgaps.ucdavis.edu>

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## Recent Outbreaks Have Caused Major Changes in Attitudes and Approaches to the Safety of Fresh Produce



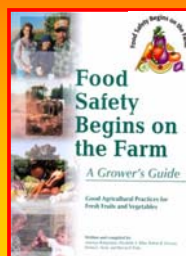
## Good Agricultural Practices A Baseline Prerequisite for Food Safety On-farm and Beyond



1996



1998



2000

## Good Agricultural Practices Focus on Prevention and Redundant Reductions

- ❖ FDA, 1998 guidance document
- ❖ “Guide to Minimize Microbial Food Safety Hazards for Fresh Fruits and Vegetables”
- ✓ Not a regulation - guidelines only
- ✓ Has become a “de facto” standard
- ✓ Buyers are the enforcement branch
- ✓ Evolving to Commodity-specific

## GAPs and GHPs ARE HACCP-based

- ❖ Systematic and Comprehensive Analysis
- ❖ Hazard Identification & Analysis
- ❖ Written Procedures and Programs
- ❖ Written Responsibilities
- ❖ Training – Awareness and Process
- ❖ Verification
- ❖ Corrective Action & Re-evaluation
- ❖ Documentation & Record-Keeping
- ❖ Positive Lot Traceback System

## EUREPGAP: GLOBAL PARTNERSHIP FOR SAFE AND SUSTAINABLE AGRICULTURE

- ❖ Euro-Retailer Produce Working Group (EUREP)
- ❖ Develop widely accepted standards and procedures
- ❖ Harmonize global certification & Audit standards
- ❖ Strongest focus on pesticide use and residues



<http://www.eurep.org>

## EUREPGAP: Audit Component Profile

Section 1.	Traceability
Section 2.	Record Keeping & Internal Self-Inspection
Section 3.	Varieties & Rootstocks
Section 4.	Site History & Management
Section 5.	Soil & Substrate Management
Section 6.	Fertilizer Use
Section 7.	Irrigation/ Fertigation
Section 8.	Crop Protection
Section 9.	Harvesting
Section 10.	Produce Handling
Section 11.	Waste & Pollution Management, Recycling & Re-Use
Section 12.	Worker Health, Safety & Welfare
Section 13.	Environmental Issues
Section 14.	Complaint Form



## WHY GAPs?

### The Consequences of Inaction

Table 2—Impact of food safety outbreak on Mexican growers, by GAP status

GAP status	Impact on:	
	Volume of green onion sales	Demand for other products
GAPs	Fairly constant	No impact
Partial GAPs	Down a bit	Some impact
No GAPs	Down by 50 percent	Down by about 90 percent
No GAPs and named by FDA	No sales and most fields plowed under	Shippers stopped selling all or almost all products from these growers

Source: Avendaño and Calvin (2004).

Market price took several months to recover  
Current litigation settlements > \$50 million

## Taking Systems Approach To GAPs

- Prerequisites
  - GAPs and GHPs
  - GMPs
  - SSOPs
- Preliminary steps
  - Team and Coordinator
  - Describe product and distribution, intended use
  - Diagrams and flow diagram
- Hazard analysis (HA)
- Prevention points
- Risk analysis

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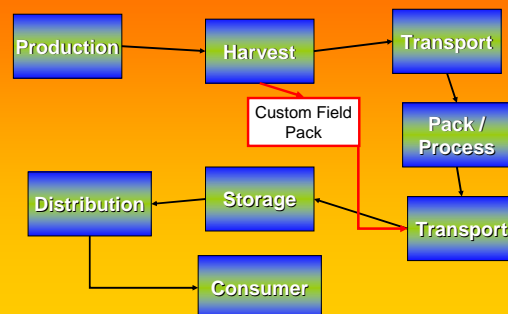
## GAPs Programs Should Not Be Passive

### Develop a system that can:

- Determine what could have happened;
- Implement procedures to determine when the process is out of control;
- Implement control measures to correct the problem;
- Verify;
- Record all actions that have been done

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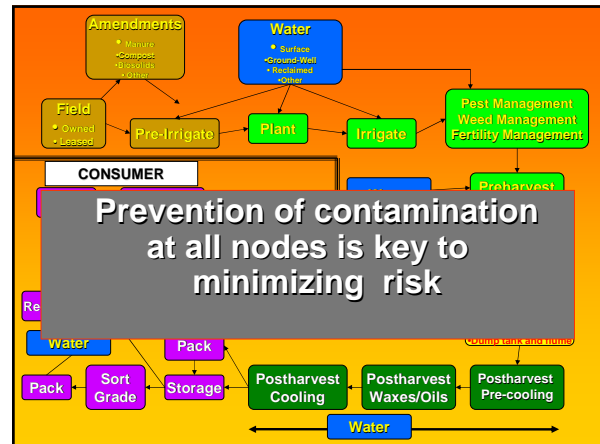
## The Starting Point for all GAPs and BMPs is a System Process Flow



## There are Multiple Nodes of Risk throughout the Chain

Describe your operation in detail

- ❖ All site characteristics
- ❖ All inputs
- ❖ All transfers
- ❖ All seasonal influences



## Implementing GAPs

Step 1: Construct a Self-Audit of Potential Hazards

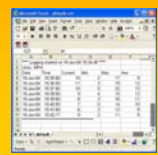
- Site selection
- Animal influences
- Fertility inputs
- Water inputs
- Irrigation
- Foliar sprays
- Harvest
- Human influences
- Worker hygiene
- Postharvest water and handling
- Sanitation – field and equipment

**Record Keeping is Essential !**



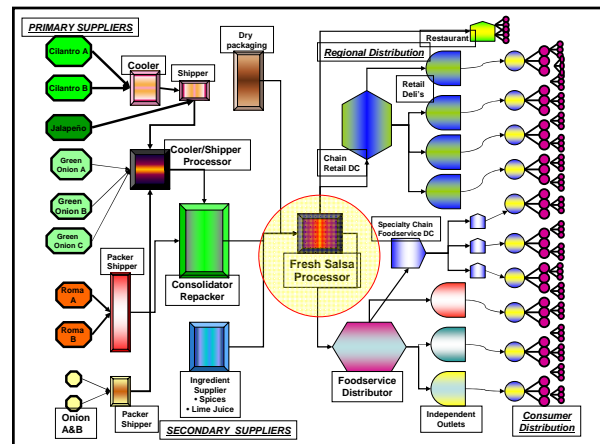
## Record Keeping is Essential !

If you didn't write it down...  
It didn't happen



## Harmonized Audits within BRC Global Standards (British Retail Consortium)

The screenshot shows the AIB International website with a sidebar listing various services and standards. The main content area displays the 'AIB Consolidated Standards for AGRICULTURAL CROPS' document, which includes a list of standards and a description of the audit process.





**Positive Lot Identification, Tracking, Traceback, and Trace Forward**

Minimum: One step back --- One step forward





**RFID Tracking Throughout the Handling System**

**smart-LABEL**

Technology: PHILIPS I-CODE  
Frequency: 13.56 MHz  
Label Quality: Polymer  
Adhesive: Acrylic

Manufactured by:



**Commercial RFID-based Tracking and Documentation Systems**



Item	Location	Quantity	Unit	Weight	Volume	Value	Notes
24 ROMAN50 SK	Box 1	1	Box	1.00	1.00	1.00	
24 ROMAN50 SK	Box 2	1	Box	1.00	1.00	1.00	
24 ROMAN50 SK	Box 3	1	Box	1.00	1.00	1.00	
24 ROMAN50 SK	Box 4	1	Box	1.00	1.00	1.00	
24 ROMAN50 SK	Box 5	1	Box	1.00	1.00	1.00	
24 ROMAN50 SK	Box 6	1	Box	1.00	1.00	1.00	
24 ROMAN50 SK	Box 7	1	Box	1.00	1.00	1.00	
24 ROMAN50 SK	Box 8	1	Box	1.00	1.00	1.00	
24 ROMAN50 SK	Box 9	1	Box	1.00	1.00	1.00	
24 ROMAN50 SK	Box 10	1	Box	1.00	1.00	1.00	



## Critical Control Point

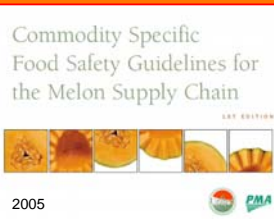
- A point, step or procedure at which control can be applied and is essential to prevent or eliminate a food-safety hazard or reduce it to an acceptable level

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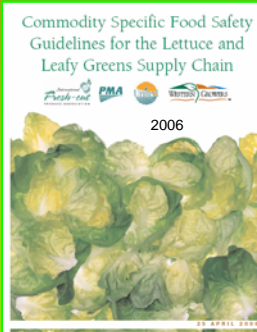
## Critical Limit

- A maximum and/or minimum value to which a biological, chemical or physical parameter must be controlled at a CCP to prevent, eliminate or reduce to an acceptable level the occurrence of a food-safety hazard

## Commodity Specific Guidance Is being Revised by Industry Associations



Next in line.....  
Fresh Market Tomatoes  
Green Onions and Herbs



## Currently in Revision to Incorporate More Specific "Metrics"

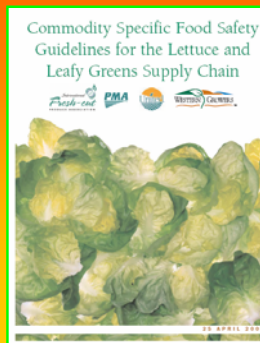
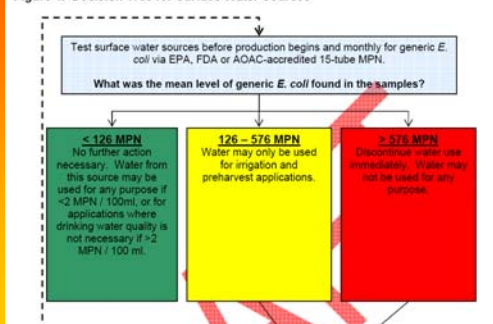


Figure 4. Decision Tree for Surface Water Sources



## Specific and Uniform Action Path is Being Debated

1. Perform generic *E. coli* testing at source.
  2. Initiate Sanitary Survey (Appendix 2)
  3. Identify any potential sources of contamination and take corrective action.
  4. Take appropriate corrective action to prevent further contamination.
  5. Decontaminate the distribution system.
- RETEST GENERIC *E. COLI* AS SOON AS FEASIBLE AFTER TAKING CORRECTIVE ACTIONS AND REPEAT DECISION TREE

Can we always predict site risks during an inspection?



## History of Adjacent Land Use

- Identify hazards that may increase the risk of contamination of fresh produce with pathogenic bacteria or toxic substances
- Contamination can be spread by water or wind, insects, animals, workers, vehicles, or equipment

## Site Selection: Risk Exposure



## Land History Concerns

- Soil may be contaminated from prior use
- Identify possible sources of contamination
  - Microbial
  - Chemical

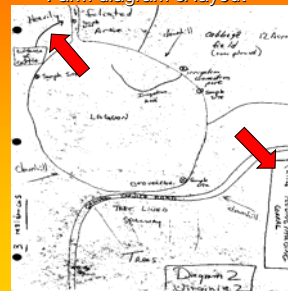


## Land History Concerns



## Potential for Contamination

Outbreak Investigation  
Farm diagram & layout



Proper GAPs  
planning should have  
captured the hazard

***E. coli* O157:H7 On Fresh Shredded Cabbage  
consecutive years of outbreaks**



**Adjacent Land Use Concern?**



March 2007: The messages are not getting through?

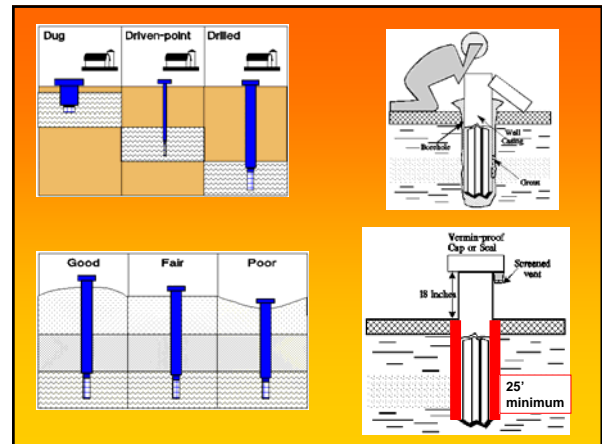
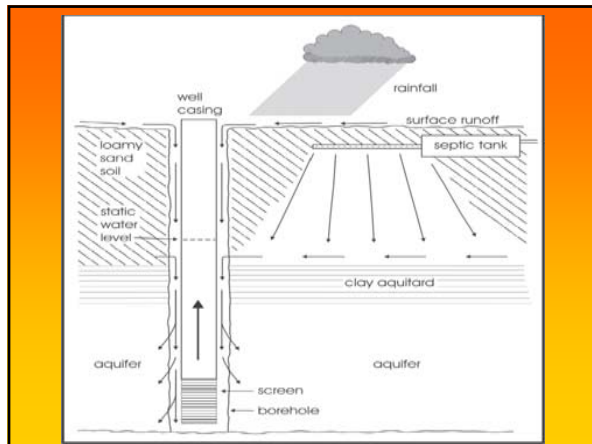
**Water: The Critical Control Point?**

Wherever water comes into direct contact with fresh produce, its quality may directly determine the potential for pathogen contamination and its persistence.

**Diverse Water Sources are Used**







## Water Quality Needs

- Vary with use
- Degree of contact with the edible portion of the crop
- Crop characteristics and growth habit
- Time until harvest

Overhead irrigation



Drip irrigation



Flood irrigation



## 2006 *E.coli* O157-Lettuce

- Shredded Lettuce supplied to Taco outlet
- Dairy wastewater applied to silage crop
- Outbreak *E. coli* genetic match found on nearby Farm – water conveyance connection



## Water Quality for Processing Must be of Highest Quality





Can we at least fix the no-brainers?



### Survival of Fecal Pathogens in Water

Pathogen	Frozen	Cold (5C)	Warm (30C)
Giardia	< 1 day	2 mo	< 3 wk
Cryptosporidium	> 1 year	> 1 year	< 3 mo
Salmonella	> 6 mo	> 9 mo	> 6 mo
Campylobacter	2-8 weeks	< 2 wk	< 1 wk
Yersinia	> 1 year	> 1 year	< 2 wk
E. coli O157:H7	> 6 mo	> 9 mo	< 3 mo

### Options to Remove Persistent *E. coli* in Reservoirs



### Potential Control Actions: Preharvest Water Chlorination



Not a Legal or Smart Set-up

Calcium hypochlorite is delivered  
by Controlled Erosion



### Hyperchlorination of Surface Water May Increase Formation of Undesirable Disinfection By-Products

Trihalomethanes  
chloroform, bromodichloromethane  
*Known or suspected cancer inducers*

Ozone < Chlorine Dioxide < Chlorine  
S. Richardson, EPA

## Understanding Soil Survival is Critical to Setting Practical Preharvest Limits

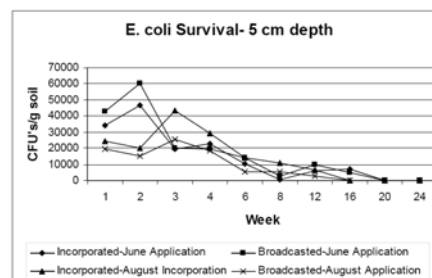
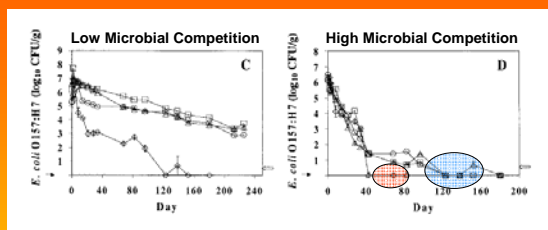


Figure 4. Example data for the survival of *E. coli* from liquid dairy manure applied to soil.

Paper Number: 022058  
ASAE Meeting Presentation



Jiang et al. AEM 2002:2605-2609

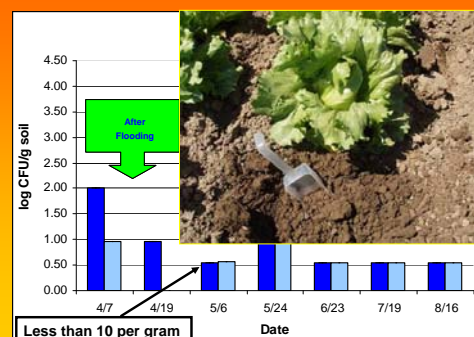
## Expectations for Survival *Salmonella*

Soil	Manure	Other
Surface or incorporated – 300 days or longer?	Feces of carrier cows - 159 days  Slurry 10 °C 132 days 20 °C 57 days 30 °C 13 days	Pasture 91 to 231 days

## Expectations for Survival *E. coli* O157:H7

Soil	Manure	Other
50 to 150 days (or more)	5 °C - 70 days 22 °C - 56 days 37 °C - 49 days  Slurry: 21 to > 70 days  Feces: > 90 days	Water: 222 to 257 days <i>E. coli</i> O157:H7 found to persist for <b>120 days in water trough sediments</b>  Feed: <i>E. coli</i> O157:H7 has been shown to proliferate in moist feeds

## 2004 Survival of Presumptive *E. coli* in Soil



### *In soil*

Pathogen death is accelerated by

1. Microbial competition
2. Incorporation into soil
3. Higher temperature  
✓  $78 > 65 > 50 > 42$  °F
4. Wide-fluctuating matric potential

### **Take home messages !!**

**#1 Food Safety Must be Planned  
From Seeding to Eating**

**#2 Details Make the Difference**

**#3 Food Safety Solutions  
Don't Have to be  
Complex or Expensive**

### ***Don't be intimidated into inaction!!***

Don't get so lost in the activity  
that you forget to use the information



**Outbreaks and Corrective Responses  
have Serious Ripple Effects**

